QUARTERLY REPORT

1. **Contract No.:** DAMD17-91-C-1081

2. **Report Date:** 28 November 1991

3. **Reporting Period:** 16 August 1991 through 15 November 1991

4. **Principal Investigator:** Dr. Robert W. Verona

5. **Telephone Number:** (205) 598-6389

6. **Institution:** UES, Inc.
4401 Dayton-Xenia Road
Dayton, Ohio 45432

7. **Project Title:** Development of Data Packages on the Human Visual Response with Electro-Optical Displays.

8. **Current staff, with percent effort of each on project:**

NAME	TITLE	HOURS*	% OF EFFORT
Dr. Robert W. Verona	Engineering Psychologist	492	98%
Dr. Victor Klymenko	Research Psychophysicist	384**	100%
Mr. Howard H. Beasley	Electronics Technician	504	100%
Mr. John S. Martin	Electro-optic Technician	504	100%
Ms. Julie B. Wriston	Technician	88***	100%

* 504 Hours were available during this reporting period not including holidays. The above hours are the actual hours worked (sick leave and vacation time have been subtracted).
** Dr. Klymenko began work effective 9 September 1991.
***Ms. Wriston resigned effective 8/30/91.

9. **Contract expenditures to date:**

Personnel	$98,557.57	Equipment & Supplies	$ 2,662.04
Travel	$ 553.70	Other	$ 323.00
		TOTAL*	$102,096.31

*Does not include facilities capital and G&A expense.

10. Comments on administrative and logistical matters.

Key Personnel:

UES hired Dr. Victor Klymenko on 9 September 1991, a Research Visual Psychophysicist for this effort in place of a Research Optometrist. With the Government's consent, a visual psychophysicist at the doctoral level was hired for the research optometrist position since the research optometrist candidates obtained through various advertisements and personal contacts were found less suited for the Research Optometrist position on this contract. Dr. Klymenko had superior psychophysics training and experience compared to the available research optometrist candidates.

11. Scientific Progress:

Physical Measurements

Using the information obtained during the literature searches, a display measurement facility was planned that could be used to replicate the various display assessment techniques as well as develop and explore new techniques. New state-of-the-art equipment was ordered for the new facility when the existing government equipment was not adequate.

The available government equipment (GFE), computer, printer, and software, and the two UES-owned computers and laser printer were determined not to be sufficient automatic data processing resources for the effort, since some of the new equipment would require dedicated computer/controllers. GFE program assets were made available to satisfy the shortage.

The physical set-up of the laboratory space is an on-going effort. Light control curtains were fabricated and installed. Fixtures to precisely hold the dual helmet mounted displays (HMDs) were fabricated and mounted, and fixtures to hold two television cameras were fabricated so the cameras can serve as a dual video source for the dual HMDs. Video source and distribution equipment were mounted in racks and configured to provide precisely controlled video signals to the various display devices.

A large Conrac monitor and a prototype Honeywell Integrated Helmet and Display Sight System (IHADSS) display were tested using several techniques. A comparison of the results from the various measurement techniques is being prepared for a SPIE presentation this Spring. The theoretical and physical measurements agreed remarkably well, demonstrating the validity of the measurement techniques. The dual IHADSS will be evaluated during the next quarter using the fixtures, equipment, and techniques developed during this quarter.

The experience we have gained interfacing and trouble shooting computer/controller hardware for the display measurements will be directly applicable to the psychophysical experiments which will require precise control and measurement of the visual stimuli. We have developed program modules for driving scanners, relay closures, digital-to-analog and analog-to-digital converters, counters, voltmeters and other instrumentation.

Psychophysical Measurements

Dr. Klymenko has been investigating the stimulus generation capabilities of the HP98731 Unix based computer graphics system. Capabilities investigated included the degree of stimulus control allowed by the "Starbase" software package on this computer system, the spatial and temporal resolution of the stimuli and the speed of stimulus generation and presentation. The limitations have been identified and needs for a psychophysical testing laboratory have been assessed and partially implemented. The HP computer will be used for stimulus generation for the psychophysical experiments and for data collection and initial data analysis.

A psychophysical laboratory for pilot experiments and experimental protocol debugging has been set-up based on the HP98731(HP), and additional parts to interface the HP to the IHADSS have been identified. The HP in its present configuration will not interface with the dual IHADSS displays. A scan converter has been ordered so the full HP potential can be used to generate stimuli on the IHADSS. Additional optical equipment to simulate the visual environment of partial overlap on the HP is being identified. Dr. Klymenko has begun designing experimental protocols based on what he has learned about the capacity of the HP.

12. Milestones

The development of the EO system evaluation plan is ahead of schedule since additional resources from the psychophysical part of the effort have been available. The development of the psychophysical study protocol is about two months behind schedule due to the absence of the Research Optometrist. During the next quarter, we will focus our attention on the psychophysical portion of the effort and synchronize both the physical and psychophysical measurement portions of the program.

The physical measurement portion of the effort will focus on two areas, the assessment of the dual IHADSS displays and the fabrication of a psychophysical testing apparatus. The repeatability of the measurements and the uniformity of performance across the display area of the dual IHADSS will be studied. The appropriate optics, displays, and subject response scoring system will be designed and fabricated based on the psychophysical research protocol.

First order of business in the psychophysical research will be the measurement of sensory thresholds across the visual field as a function of overlap factors to assess the influence of overlap, degree of overlap and overlap edges on visual thresholds for spatio-temporally modulated stimul. The method will be a staircase threshold estimation procedure and the data will be spatio–temporal contrast threshold surfaces as a function of the above variables. In addition to sensory factors (such as basic contrast thresholds), higher order perceptual factors (e.g., motion direction detection) and cognitive factors (e.g., attentional effort) will be investigated also.

A copy of the display quality measurement comparison paper will be forwarded to Dr. Wiley for review prior to submission to SPIE and distribution IAW paragraph F.5 of the basic contract.